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THE INFLUENCE OF SOIL ORGANIC MATTER ON ADSORPTION BEHAVIOR OF TERBUTHYLAZINE IN BIOCHAR AMENDED SOILS

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INTRODUCTION

Organic matter (OM) plays an important role in the adsorption of pesticides in the soil. Biochar (BC) is added to the soil in order to enhance OM content and to improve soil capacity for water- and nutrient-holding capacity. BC can improve agricultural productivity, particularly in low-fertility and degraded soils, it reduces the losses of nutrients and agricultural chemicals in run-off, it can improve the water-holding capacity of soils, and can decrease the mobility and bioavailability of organic pollutants. BC (Figure X) is a carbon-rich and porous material produced by pyrolysis of biomass under oxygen-limited conditions.

AIM of this work was to investigate the influence of the OM content in soil amended with BC on adsorption behavior of terbuthylazine (Figure 1) – widely used triazine herbicide in maize crop protection

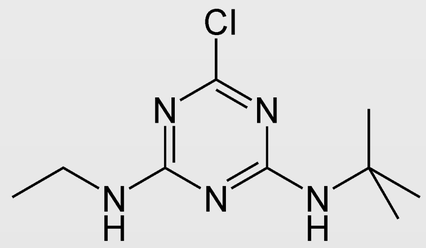

Figure 1. Terbuthylazine

MATERIAL and METHOD

Soil 1, 2, and 3 used in the study contained 0.48%, 2.34%, and 4.12% OM, respectively. Commercially available compost-activated biochar produced by pyrolysis of beechwood chips (BC) at 700°C and BC produced by pyrolysis of sunflower crop residues (SC) at 700°C were used, both provided by BASNA (Čačak, Serbia). A batch adsorption experiments were conducted to investigate terbuthylazine adsorption in unamended soil and with the amendment of various doses of BC (0, 1, 5, and 10%). The concentration of herbicides in the aqueous phase at equilibrium, which is achieved after 72 h, was determined by GC-MS.

RESULTS AND DISCUSSION

The adsorption isotherms were well described with the Freundlich model (R^2 values ranged from 0.714 to 0.998). Values of Freundlich exponent *n* were less than 1 and they vary from 0.400 to 0.944. Single-point distribution coefficients (K_d) were calculated at selected equilibrium concentration (c_e= 100 µg dm^{-3}). K_d values for unamended Soil 1, 2, and 3 were 1.14, 14.13 and 12.65, respectively. In unamended Soil 1 the adsorption of terbuthylazine was lower in comparison to Soil 2 and Soil 3, which is in accordance with the fact that the OM content primarily affects the adsorption of pesticides in soil. K_d values in soil types amended with beechwood BC were in the range 3.72–30.92 in Soil 1, 10.56–50.74 in Soil 2, and 20.82–47.03 in Soil 3, while K_d values in soil types amended with sunflower crops residues BC ranged 14.80–2099.81 in Soil 1, 8.99–985.51 in Soil 2, and 19.98–946.28 in Soil 3.

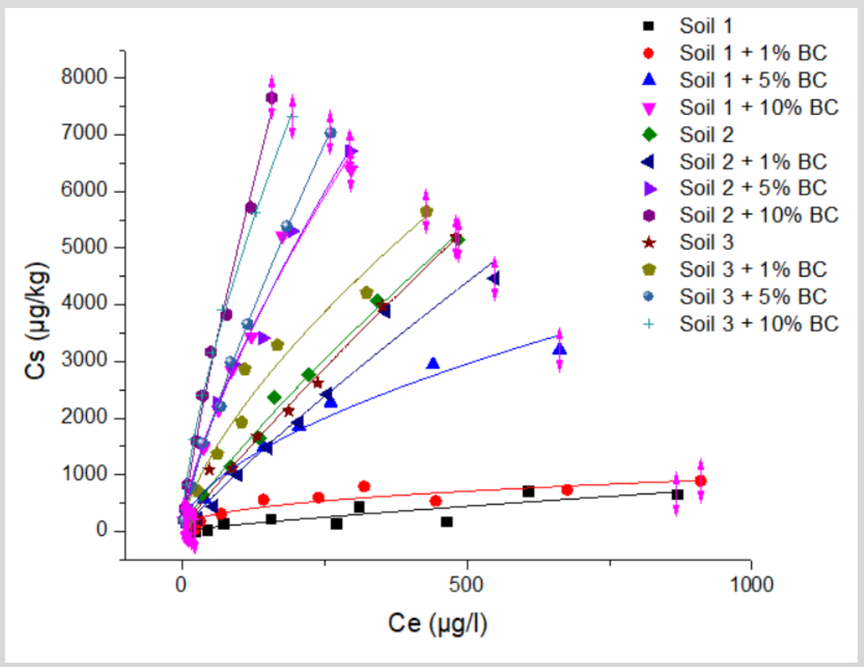

Figure 2. Adsorptive isotherms for terbuthylazine in Soil 1, Soil 2, and Soil 3, unamended and amended with 1%, 5%, and 10% BC

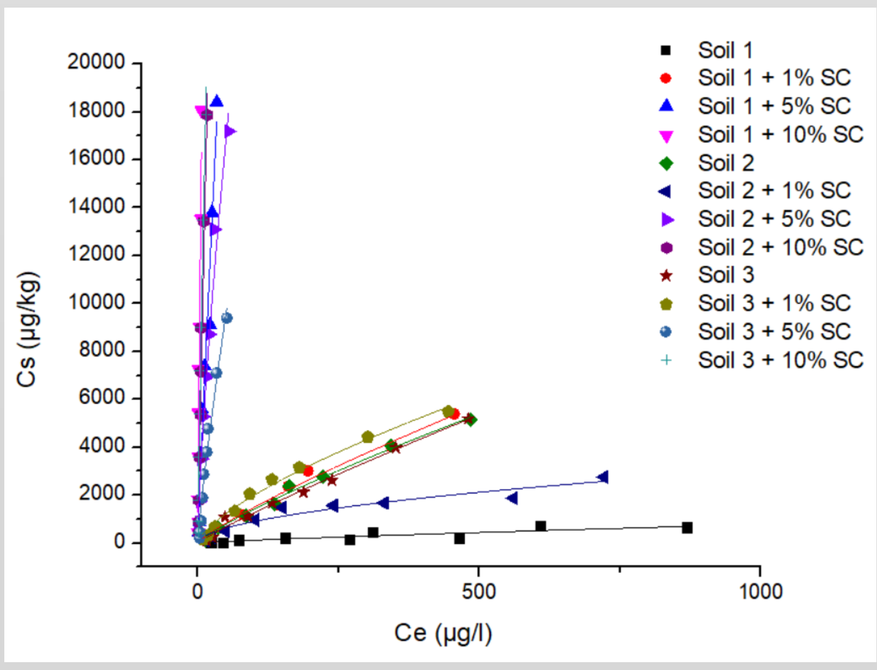

Figure 3. Adsorptive isotherms for terbuthylazine in Soil 1, Soil 2, and Soil 3, unamended and amended with 1%, 5%, and 10% of SC

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CONCLUSION

The results showed that the sorption capacity increased with increasing the doses of BC and was higher in soil types amended with sunflower crop residues BC. Both types of BC increased the sorption capacity of soil for terbuthylazine. Higher OM content in soil increases the sorption capacity of terbuthylazine in unamended soil, as well as in amended. However, with higher doses of both BC types, there is less difference between sorption capacities of soil types, which indicates that BC has an important role in adsorption in amended soils.